Course Title: Communication systems	Course Code: EEC2247	Second Year
Date: 12-6-2014	Allowed time: 3 hrs	No. of Pages: (2)

Answer all the following questions:

Question (1) (20 degrees)

1. Find the exponential Fourier series for the periodic waveform $g_p(t)$ shown in Figure (1) and plot its amplitude spectrum. (A=1)

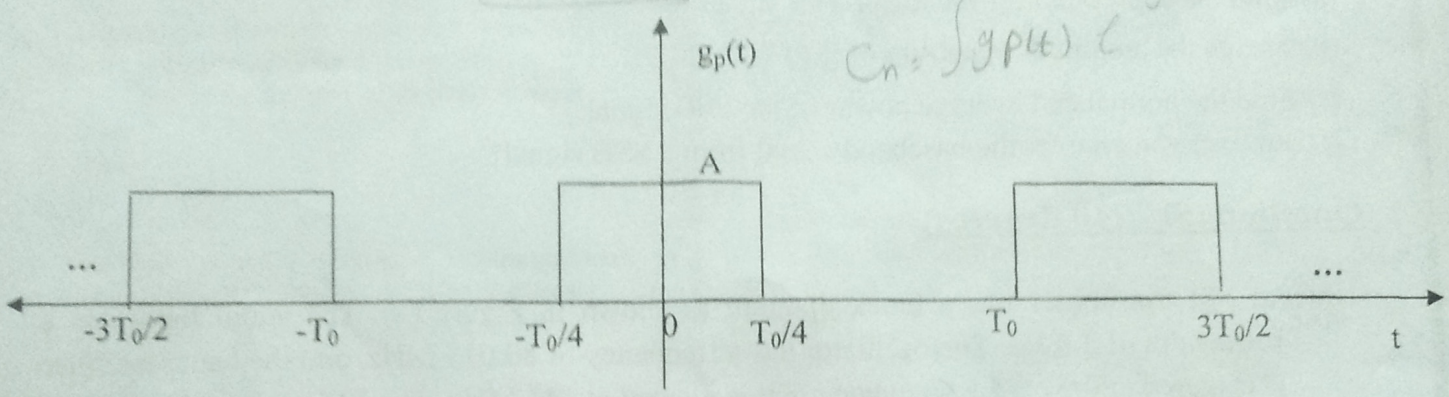

Figure (1)

2. Proof that the normalized power of a periodic waveform $g(t)$ is given by :

$$P_w = \sum_{m=-\infty}^{\infty} |C_n|^2$$

Question (2) (20 degrees)

(1) If the Fourier transform of a signal $g(t)$ is denoted by $G(f)$. Prove the following property of the Fourier transform:

$$\int_{-\infty}^{\infty} g(t)dt \Leftrightarrow \frac{1}{j2\pi f}G(f) + \frac{G(0)}{2}\delta(f)$$

(2) Find the Fourier transform for the following functions:

(a) $w(t) = rect.(\frac{t-5}{10}) + 8\sin(6\pi t)$

(b) $x(t) = 5 - 5e^{-2t}u(t).$

(c) $x(t) = \Delta(\frac{t}{2})$

Question (3) (20 degrees)

(1) An AM signal is generated by modulating the carrier wave f_c=800 kHz by the signal $m(t) = -0.2 + 0.6\sin(4000\pi t)$,

a. Find the AM wave in the time domain and sketch the spectrum of it.

b. Determine the average power in the carrier and in the sidebands.

c. What is modulation index?

d. What is the peak power delivered to the 50 Ω load?

(2) A signal $m(t)=2\cos(4000\pi t)$, is transmitted by DSB-SC modulator by using a carrier $c(t)=4\cos(10000\pi t)$, determine the following:

(a) The spectrum of the DSB-SC signal.

(b) How can you demodulate the signal using coherent detector?

(c) Show, how can you recover the baseband signal from the DSB-SC wave by using the squaring loop receiver.

(d) What is the transmitted bandwidth?

Question (4) (20 degrees)

(1) A SSB-AM transmitter is modulated with the baseband signal $m(t)=0.5\cos(300\pi t)$, the carrier signal has $A_c=3$ *Volt*, *and* $f_c=4\,kHz$.

(a) Find the expression for the lower SSB signal.

(b) Sketch the amplitude spectrum of $|S(f)|$.

(c) Find the normalized average power of the SSB signal.

(2) How can you recover the baseband signal from a SSB signal?

Question (5) (20 degrees)

(1) An FM transmitter has a block diagram as shown in Figure (2). The audio input has a bandwidth of 3 KHz. The oscillator has a frequency of 80.015 MHz, and the bandpass filter is centered at the carrier frequency that is located at 143 MHz. The FM exciter has a carrier frequency 20.9957 MHz and a peak deviation of 0.694 KHz when the audio signal is applied. Calculate the carrier frequency and the peak deviation of the FM signal at points B, C, D, E, and F.

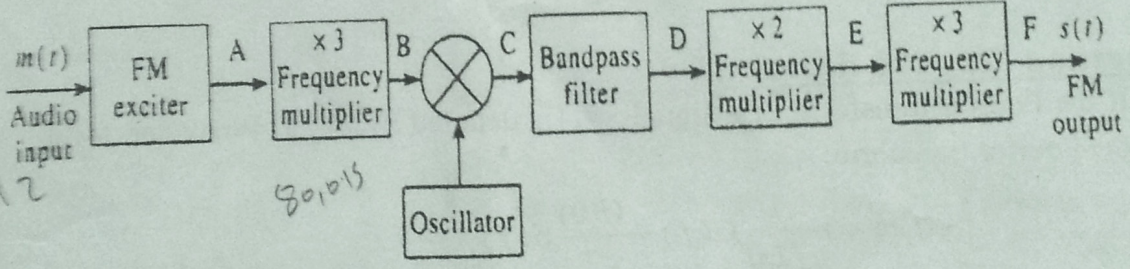

Figure (2)

(2) Explain how the Phase Locked Loop (PLL) can be used to demodulate the FM wave.

Good Luck

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